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EXAMINER

BERDICHEVSKY, MIRIAM

ART UNIT

PAPER NUMBER

1795

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/537,754	Applicant(s) REPETTO ET AL.	
	Examiner MIRIAM BERDICHEVSKY	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 July 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 4-37 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 4-37 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claim 1 is objected to because of the following informalities: it is the Examiner's opinion that the word "planer" should read "planar". Appropriate correction is required.

Claim Analysis

The Examiner notes that the limitations of the preamble of claim 1 are not given patentable weight. Moreover, should they be given weight it would have been obvious to one having ordinary skill in the art at the time of the invention to duplicate the conversion module to produce more energy, since it has been held that mere duplication is within the skill of a worker in the art.

Status of Rejections

The rejections under 35 U.S.C. 112 are withdrawn in view of Applicant's amendment.

All other rejections are withdrawn in view of Applicant's amendment having altered the scope of the claims. New ground of rejections is presented below.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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3. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. Claims 1, 4-8, 19, 28, 31 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman (US 6372979) and Malfa (US 20030230336).

As to claim 1, Streetman teaches a conversion module comprising a combustion chamber having a substantially spherical shape (16) wherein one of ordinary skill would appreciate that the combustion chamber must be made of a material able to withstand high temperatures. Streetman discloses a conduit for supplying a combustion support substance into the combustion chamber (28), a means for removal of gaseous combustion products (col. 3, lines 29-35). One of ordinary skill would appreciate that in order for combustion to occur a means for igniting the combustion reaction must be present. Streetman teaches an injection device (23, 27) connected to the combustion chamber by an injection conduit (col. 3, lines 60-65), a controller of the injection frequency (sensor, col. 3, line 63), a means for selective emission of radiation onto an outer surface of the combustion chamber (col. 3, lines 32-36 and col. 3, lines 50-55), a conversion chamber housing the combustion chamber at its focus point (12), and a solar cells positioned on a surface of the conversion chamber (25) (figure 2). In addition, the Examiner notes similarities Streetman teaches pertaining to the instant

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disclosed invention such as the inclusion of a mirrored surface on the conversion chamber to reflect light emitted onto the surface with solar cells.

Streetman is silent to the conversion chamber shape being semi-ellipsoidal and the solar cells specifically being located on the planar surface of the semi-ellipsoidal surface and the conversion chamber being sub-stmospheric.

Malfa teaches a thermophotovoltaic device which uses a burner device ([0035]) to ignite combustion releasing hot gasses (13) within a conversion chamber (28, 102) ([0035]) maintained in vacuum (sub-atmospheric) to heat an emitting surface (501) to emit light for use by solar cells placed on a planar surface of the conversion chamber. The Examiner notes that one of ordinary skill would appreciate that (21, 100) acts as a combustion chamber (figure 3). Malfa is relied upon as a teaching that the shape of the conversion chamber is a design choice and can be designed according to the needs ([0034]) and that the solar cells may be placed on planar surfaces within the conversion chamber.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a semi-ellipsoidal shape for the conversion chamber because a semi-ellipsoidal shape occupies less space and can be conform to different environments given that a change in shape is generally recognized as being within the level of ordinary skill of a worker in the art (MPEP 2144). It would have been obvious to one of ordinary skill in the art at the time of the invention to place the solar cells on the planar surface of the semi-ellipsoidal shape because flat surfaces make attachment of solar cells easier than curved surfaces, especially in light of the fact that it has been held to

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be within the skill of a worker to rearrange parts of an invention (MPEP 2144). Finally, the Examiner notes that despite the shape and placement of the solar cells the prior art has the same concept and effect as that of the instant invention and changing the shape and placement of the solar cells within that shape would have had a reasonable expectation of success and produced predictable results (MPEP 2141). It would have been obvious to one of ordinary skill in the art at the time of the invention to maintain a vacuum within the conversion chamber of Streetman to attain the theoretical speed of light which is based on vacuum conditions. The Examiner notes that one of ordinary skill would appreciate how to use Streetman solely based on combustion emissions allowing for vacuum modification.

Regarding claim 4, modified Streetman teaches that the means for the conversion of radiant energy into electrical energy comprise a plurality of photovoltaic cells (Streetman: col. 3, lines 40-50 and Malfa: [0028]).

Regarding claim 5, modified Streetman teaches that the selective emission of radiation have a narrow emission band with a peaking correspondence with the wavelength at which the conversion means have the maximum conversion efficiency (Malfa: [0031]). Also, one of ordinary skill would appreciate selecting the wavelengths for which the solar cells optimally convert because they would increase overall efficiency.

Regarding claim 6, modified Streetman teaches the use of Kanthal (micro-structure metal) applied on the outer surface of the combustion chamber to emit radiation selectively (Malfa: [0029]). Moreover, it would have been obvious to one of

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ordinary skill in the art to use rare earths as the lining as it has been held that selection of a known material based on its suitability for its intended purpose is within the general skill of a worker in the art (MPEP 2144.07).

Regarding claims 7-8, modified Streetman is silent to the specific dimensions of the device components and thus is silent to the outer surface of the combustion chamber having such a total area that the radiant energy emitted by the emission means is equal to the sum of the total thermal energy developed by the combustion reaction at steady state and of the fraction of radiant energy that is reflected by the inner walls of the conversion chamber or by the conversion means and reabsorbed by the combustion chamber (claim 7) and the conversion chamber has axes whose size ranges between 3 and 50 times the diameter of the combustion chamber (claim 8).

It would have been obvious to one of ordinary skill in the art at the time of the invention to make the outer surface of the combustion chamber having such a total area that the radiant energy emitted by the emission means is equal to the sum of the total thermal energy developed by the combustion reaction at steady state and of the fraction of radiant energy that is reflected by the inner walls of the conversion chamber or by the conversion means and reabsorbed by the combustion chamber in modified Streetman in order to optimize the conversion efficiency of the system as it has been held that the mere change in size of components and the discovery of an optimum value of a result effective variable are within the general skill of a worker in the art (MPEP 2144).

Regarding claim 19, modified Streetman teaches separate injection of fuel into the combustion chamber (figure 3).

Regarding claim 28, modified Streetman teaches that the gaseous fuel injected is a natural gas (Streetman: col. 3, lines 25-30).

Regarding claim 31, modified Streetman teaches the use of a valve which may be cut off thereby preventing combustion products returning towards the injection means (Streetman: col. 3, lines 60-65). Broadly interpreted the valve acts to create segments within the conduit and thus reads on the instant claimed invention. Moreover, it would have been obvious to one of ordinary skill in the art at the time of the invention to use an articulated joint to solve the same problem as articulated joints are commonly used as traps in tubing.

Regarding claim 33, modified Streetman teaches that a vacuum is obtained inside the conversion chamber (Malfa: [0028]).

5. Claims 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman and Malfa as applied to claim 1 and further in view of Fischbeck (US 3924974)

Regarding claims 9-10, modified Streetman is silent to the injector being a "bubble" ink-jet type.

Fischbeck teaches the use of ink-jet injectors for combustion chambers (col. 5, lines 25-40).

It would have been obvious to one of ordinary skill in the art at the time of use the "bubble" ink-jet injector of Fischbeck because the volumetric change provided by the ink-jet printer is hundreds of times greater than that of prior art structures, as taught by Fischbeck (col. 7, lines 49-57).

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6. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman and Malfa as applied to claim 1 and further in view of Yoshinaga (JP 58180767)

Regarding claim 11, modified Streetman is silent to an injection head being piezoelectric.

Yoshinaga teaches the use of a piezoelectric driver for injectors (abstract).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the piezoelectric head of Yoshinaga in the injection means of modified Streetman because the piezoelectric element accelerates the combustion of fuel, as taught by Yoshinaga (purpose).

7. Claims 12 and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman and Malfa as applied to claim 1 and further in view of Wagner (US 3779212)

Regarding claims 12 and 15-16, modified Streetman is silent to the combustion chamber being constituted by a material with high thermal conductivity and able to withstand high temperatures (claim 12), a metallic material (claim 15) and that material being tungsten or molybdenum (claim 16). However, the Examiner asserts that one of ordinary skill in the art would appreciate that a combustion chamber must withstand high temperatures and would select a known material for this purpose.

Wagner teaches that materials such as tungsten and molybdenum are used in combustion chambers because they are conventional high temperature materials (col. 4, lines 1-7).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the materials of Wagner in modified Streetman for the combustion chamber because these materials can withstand the high temperatures of combustion, as taught by Wagner (col. 4, lines 1-7) especially since it has been held to be within the general skill of a worker in the art to select a known material based on its suitability for an intended use (MPEP 2144.07).

8. Claims 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman and Malfa as applied to claim 1 and further in view of DE'743 (DE 5620131).

Regarding claims 13-14, modified Streetman is silent to the inner surface of the combustion chamber being coated with a porous material with low thermal conductivity, able to withstand high temperature and coated with a catalyzing material (claim 14).

DE '743 teaches the inner surface of the combustion chamber being coated with a porous material with low thermal conductivity, able to withstand high temperature and coated with a catalyzing material (abstract).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the material of DE'743 in modified Streetman because the lining reduces noxious emissions, as taught by DE'743 (abstract) especially in light of the fact that modified Streetman is concerned with reduction of noxious emissions (Malfa: [0036]).

9. Claims 17-18, 20 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman and Malfa as applied to claim 1 and further in view of Horne (US 5611870).

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Regarding claim 17, modified Streetman teaches removal of exhaust gas through a conduit (residual heat/exchanger tubes Malfa: [0036]) but is silent to the specific materials used for all conduits.

Horne a thermophotovoltaic device comprising a combustion chamber (210) for releasing emitted light (220) onto solar cells (190) wherein the exhaust conduits are made of a material with low thermal conductivity (col. 13, lines 22-24) but remains silent to the injection conduit and the conduit for supplying the combustion support substance being made of a material with low thermal conductivity.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply the low thermal conductivity throughout the conduits in Horne and modified Streetman in order to reduce heat and efficiency losses in combustion as Horne teaches the importance of saving costs by using preheated fuel and air supplies (col. 12, lines 29-32 and 53-64).

Regarding claim 18, modified Streetman teaches that the outermost segment of the exhaust conduit is made of a material with high thermal conductivity to allow combustion products to yield the residual heat before exiting the conversion chamber (Malfa: [0036] and Horne: col. 12, lines 36-47).

Regarding claim 20, modified Streetman is silent to the support substance conduit ending into the injection conduit before entering the combustion chamber.

Horne teaches that the injection of the combustion support substance ends into the injection conduit before entering the combustion chamber (col. 12, lines 65-67).

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It would have been obvious to one of ordinary skill in the art at the time of the invention to use the combined conduits of Horne in modified Streetman because the premixed fuel allows for uniformity in the combustion chamber (Horne: col. 12, lines 65-67).

Regarding claim 23, modified Streetman is silent to the surface of the photovoltaic cells facing the interior of the conversion chamber has an optical lining with transmittance peak in correspondence with the wavelength at which the photovoltaic cells have the maximum conversion efficiency and the use of an optical lining operating on the long wavelengths of the electromagnetic radiation as a band pass filter. The Examiner notes that the functional language is not given patentable weight as it does not impart structure on the instant invention and therefore does not distinguish the product from the prior art.

Horne teaches that the surface of the photovoltaic cells (190) facing the interior of the conversion chamber has an optical lining (band pass filter (218)) with transmittance peak in correspondence with the wavelength at which the photovoltaic cells have the maximum conversion efficiency (figure 43, col. 11, line 61).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the optical lining of Horne in modified Streetman because filtering the light reduces overheating of solar cells and allows for maximum efficiency.

10. Claims 21-22, and 35-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman and Malfa as applied to claims 1 and 33 and further in view of Nelson (US 4584426).

Regarding claims 21-22, 35-37, modified Streetman teaches that the conversion chamber may comprise an inner surface of reflective material to reflect radiation onto the solar cells (Streetman: col. 3, lines 50-55) but is specifically silent to the conversion chamber being formed within a structure made of optically polished metallic material, reflecting over the whole spectrum of the radiation emitted by the emission means.

Nelson teaches a thermophotovoltaic system in which the combustor (mantle) is housed within a structure made of polished metallic material (col. 6, lines 45-47).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the polished metallic structure of Nelson in modified Streetman because the reflective structure reflects unabsorbed light back into the device rather than waste the energy.

Further regarding claim 22, modified Streetman is silent to the optically polished material being coated on a plastic or ceramic.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a plastic or ceramic coated with highly reflective material in modified Streetman because using a coating allows for the bulk of the structure to be made from less expensive materials such as plastic.

Further regarding claim 36-37, modified Streetman is silent to the optically polished material being a ceramic.

It would have been obvious to one of ordinary skill at the time of the invention to use a polished ceramic because polished ceramic can withstand high temperatures and will reflect unabsorbed radiation over the whole spectrum emitted by the emission

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means back into the system, especially since it has been held to be within the general skill of a worker in the art to use a known material based on its suitability for its intended use (MPEP 2144.07).

11. Claims 24-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman and Malfa as applied to claim 1 and further in view of Ikai (US 5620531).

Regarding claims 24-25, modified Streetman is silent to the use of a solar cell based on Schottky junctions comprising silicon and aluminum.

Ikai teaches that pn-, pin-, and Schottky junction solar cells are equivalents known in the art (col. 23, lines 35-37), wherein the Schottky junction comprises aluminum as the metallic component (col. 23, lines 41-43) but is silent to the semiconductor. Andriesh teaches that aluminum on amorphous silicon produces Schottky devices.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the Schottky junction solar cell of Ikai and Andriesh in modified Streetman because Schottky devices are known to be faster than pn- or pin- devices, as taught by Andriesh (page 351) especially since it has been held to be within the general skill of a worker to select a known material based on its suitability for its intended use (MPEP 2144.07).

12. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman and Malfa as applied to claim 23 and further in view of Fraas (US 5403405).

Regarding claim 26, modified Streetman is silent to the optical lining is made of a material selected from the group comprising: multilayer dielectric lining, metallic lining at the percolation state, metallic photonic crystal, anti-reflection micro-structure.

Fraas teaches the use of a multi layered dielectric layer for filtering in thermophotovoltaics (claim 1).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the multilayer dielectric layer of Fraas in modified Streetman because the multilayer can withstand high temperatures (claim 1).

13. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman and Malfa as applied to claim 1 and further in view of Nakanishi (US 6295937).

Regarding claim 27, modified Streetman is silent to the injection device being a miniaturized Bunsen burner.

Nakanishi teaches the use of a Bunsen burner injection device (col. 12, lines 60-67).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a Bunsen burner as an injection device because bunsen burners gasify liquid fuels (col. 12, lines 60-67).

14. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman and Malfa as applied to claim 1 and further in view of Yoshida (US 4090482).

Regarding claim 29, modified Streetman is silent to the exhaust conduit being internally coated with catalyzing material able to neutralize the noxious products of the combustion reaction.

Yoshida teaches catalyzing material in an exhaust pipe for a combustion apparatus (claim 1).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the exhaust conduit of Yoshida in modified Streetman because the catalyzing material reduces noxious chemicals (claim 1) especially in light of the fact that modified Streetman is concerned with reduction of noxious emissions (Malfa: [0036]).

15. Claims 30, 32 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman and Malfa as applied to claim 1 and further in view of Noreen (US 5512108)

Regarding claim 30, modified Streetman teaches that the exhaust conduit has path in order to favor the cooling of the exhaust gas (col. 12, lines 40-45).

Noreen teaches the use of articulated exhaust paths (col. 12, line 56).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the articulated paths of Noreen in modified Streetman to improve efficiency (col. 12, lines 50-54).

Regarding claim 32, modified Streetman is silent to spark ignition.

Noreen teaches that spark ignition is the conventional method of igniting the combustion chamber in thermophotovoltaics (col. 5, lines 9-10).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the spark ignition of Noreen in modified Streetman because one of ordinary skill would appreciate that spark ignition is a simply method for igniting the combustion chamber.

Regarding claim 34, modified Streetman teaches a sub atmospheric chamber (Malfa: [0028]) but is silent to the use of an inert gas sub atmospheric pressure chamber.

Noreen teaches the use of an inert gas as an alternative to a vacuum (col. 16, lines 42-48).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use an inert gas at sub atmospheric pressure in order eliminate oxygen from being absorbed by photons, as taught by Noreen (col. 16, lines 42-48).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

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extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **MIRIAM BERDICHEVSKY** whose telephone number is (571)270-5256. The examiner can normally be reached on M-Th, 10am-8pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer Michener can be reached on (571) 272-1424. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/M. B./

Examiner, Art Unit 1795

/Jennifer K. Michener/

Supervisory Patent Examiner, Art Unit 1795